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Viewing the school system as a set of subsystems with intersubsystem inputs and outputs, an organizational structure assessment instrument was designed to test the hypothesis that quantification of these inputs and outputs would make possible the determination of internal conditions of the school system which contribute to differences in school performance. Two general dimensions--content of interaction and structure of interaction--were defined from previous studies analyzing relationships among people, groups, and concepts. These two dimensions were further classified and integrated into a conceptual scheme of six basic and nine interaction dimensions. The instrument directed respondent's attention toward organizational rather than personal relationships. Respondents included administrators in 14 New York State public school systems. Output was computed as achievement levels of 3d and 6th grade pupils in October 1967. Findings were generally consistent with expectations, indicating utility of the instrument for both theoretical and operations research. A copy of the Organizational Structure Survey instrument is appended. (JK)

Measuring the Functional Structure of Complex Organizations

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Introduction. Investigations using input-output analyses of schools have generally found that a large percentage of a school's output is predictable from its inputs. Furthermore, variations in school programs appear to have a disappointingly small impact on output after the effects due to input differences have been accounted for. Evidently, something that is not now being measured is responsible for output variance which is attributable to within-school causes.

Perhaps if the school system were broken down into subsystems and the inputs and outputs to each of these subsystems were quantified, we would be better able to identify the type, amount, and location of the internal conditions which contribute to the differences in school performance. To test this hypothesis an instrument was designed to measure what were believed to be the significant dimensions of inter-subsystem inputs and outputs. In this paper it is assumed that structure is measurable in terms of the prevailing "flows" among subsystems within the organization.

Specifying Structure Dimensions. In order to quantify the flows to and from each subsystem it is necessary to determine what flow dimensions to be concerned with. This problem was approached by adopting dimensions suggested by various studies which analyzed relationships among people, groups, and concepts. Many of these studies were classifiable along a continuum. Studies dealing with the content of interactions were at one end and studies dealing with the structure of interactions were at the other.

The Content-oriented studies were analysed to determine how they might be further classified into dimensions. It seemed that they could be dimensionalized as shown in Figure 1.

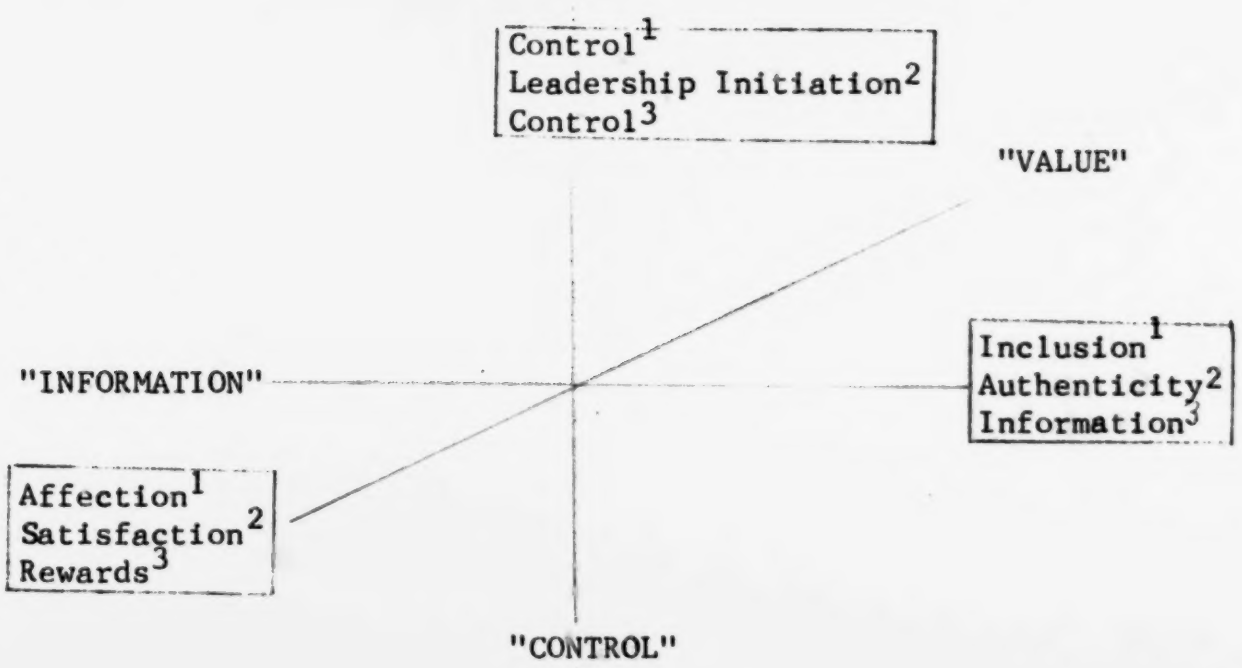

FIGURE 1.
DIMENSIONS SUGGESTED BY CONTENT-ORIENTED
STUDIES OF SOCIAL INTERACTIONS

These three dimensions were defined as--

A. Information: The presence or absence of knowledge, understanding, awareness, etc. as a component of a relationship or subsystem.

B. Value: The presence or absence of a positively or negatively motivating component of a relationship or subsystem.

C. Control: The presence or absence of a directive or constraining component in a relationship or subsystem.

The Structure-oriented studies seemed to deal with variables which could be dimensionalized as shown in Figure 2.

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[1]William C. Schutz, FIRO: A Three-Dimensional Theory of Interpersonal Behavior (New York: Rinehart, 1958)

[2]Andrew W. Halpin and Don B. Croft, The Organizational Climate of Schools (Chicago: Midwest Administration Center, The University of Chicago, 1963), pp. 130.

[3]James G. March and H. A. Simon, Organizations (New York: Wiley, 1958). p 53.

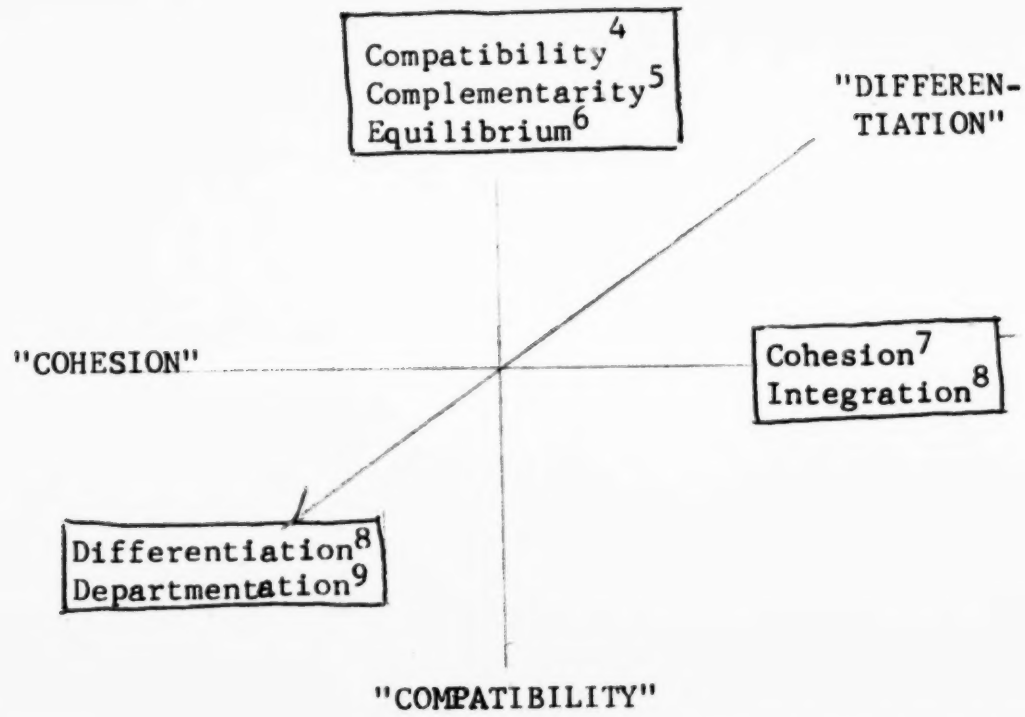

FIGURE 2.
DIMENSIONS SUGGESTED BY STRUCTURE-ORIENTED
STUDIES OF SOCIAL INTERACTIONS

These structure dimensions were defined as--

D. Cohesion: The size of a Content component (i.e. Information, Value, Control) in a relationship or subsystem.

E. Compatibility: The difference in size between a Content component in one relationship or subsystem as perceived from different vantage points.

F. Differentiation: The difference in size between a Content component in one relationship or subsystem and in another relationship or subsystem within the same system.

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[4]Schutz, op. cit., pp. 128-135.

[5]Eric Berne, The Structure and Dynamics of Organizations and Groups (Philadelphia: J.B. Lippincott Co., 1963), pp. 139-145.

[6]Herbert A. Simon, "A Formal Theory of Interaction in Social Groups," American Sociological Review, Vol. XVII, No. 2 (April, 1952).

[7]A. Paul Hare, Small Group Research (New York: Free Press of Glencoe, 1962), p. 387.

[8]Paul R. Lawrence and Jay W. Lorsch, "Differentiation and Integration in Complex Organizations", Administrative Science Quarterly, Vol 12, (june 1967), pp. 1-47.

[9]Ralph M. Stogdill, "Dimensions of Organization Theory" in James D. Thompson (Ed.) Approaches to Organizational Design (University of Pittsburgh Press), pp. 1-56.

The Content and Structure dimensions were integrated into one conceptual package of 6 basic and 9 interaction dimensions as shown in Figure 3.

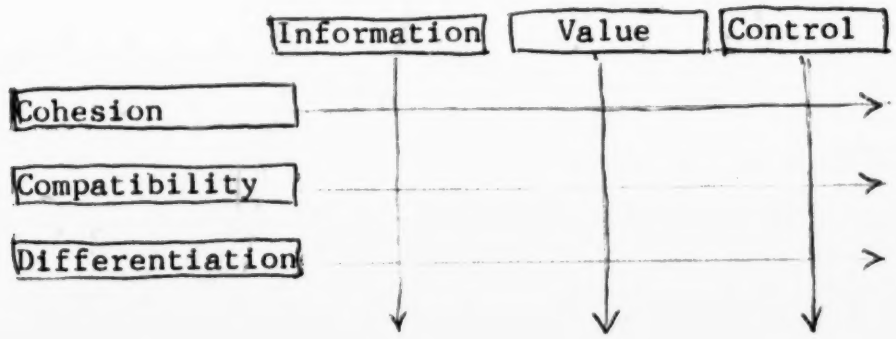

FIGURE 3.
SYNTHESIS OF CONTENT AND STRUCTURE
DIMENSIONS OF ORGANIZATION

A few examples may clarify the meaning of this conceptual scheme. The framework in Figure 3 suggests that there are three types of Cohesion, three types of Compatibility, etc. Cohesion may be a function of the size of the Information component of flows between subsystems. For example, a research organization might be typified by a high degree of Information Cohesion. Cohesion is also a function of the size of the Value component of interactions. A social fraternity, for example, might be found to have relatively high Value Cohesion. Where the Control component of interactions is high a more militaristic organization might be found.

Measurement of Structure Dimensions. There are several ways to measure each of the dimensions discussed, but in the absence of data there is no way to know which method is most effective. Therefore, an instrument was designed to measure the impact on the criterion of each of the 6 methods used in combination with each of the 9 interaction dimensions to be measured. Thus it was possible to measure the correlation of each Method x Dimension variable with the criterion variable (school system performance) to ascertain which method worked best with which dimension.

Although the instrument (Appendix A) resembles a sociometric device, it differs in several respects: a) the respondent's attention is directed toward relationships and subsystems which are organizationally rather than personally significant, b) the direction, size and quality of prevailing interactions are recorded, c) the magnitude of a relationship is not assessed by number of choices given or received but by the scale ratings made on a fixed number of choices and d) a small number of semantic differential scales are used to measure all flows to and from subsystems.

Testing of the Instrument. Previous investigations have suggested that organizations with relatively high levels of Differentiation and Integration (dimensions similar to those which this instrument is intended to measure) tend to have relatively high levels of performance.[10]

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[10] Lawrence and Lorsch, loc, cit.

Therefore, the significance of the correlations found between the instrument scores and independent estimates of organizational performance provided a method for evaluating the instrument's predictive validity. The following evaluation steps were involved:

1. The instrument was administered to/14 New York State public administrators in school systems. (The systems were not necessarily representative of a particular population of school systems.)
2. The school systems actual output in terms of the tested achievement levels of 3rd and 6th grade pupils measured in October 1967 was computed. Predicted levels were computed by a multiple regression equation involving the variables shown in Table III of the Appendix.
4. The difference between each system's <u>actual</u> and <u>predicted</u> output was taken as an indicator of the system's overall performance.
5. Correlations between the Structure scores and performance scores were computed and tested for level of significance.

<u>Results</u>. The correlations in Tables I and II (pages 8, 9) were positive (as predicted) except for the Value-Cohesion and Control-Cohesion dimensions. The most successfully measured dimension was Differentiation. Its effectiveness as a predictor was strongest where the Value content and Control content were involved. In general, the Information and Control dimensions contributed most to the prediction of performance.

The general pattern of correlations in Tables I and II were similar. However, it is apparent that a considerable increase in prediction is possible if the scores are weighted. Weighting also produced a sizeable increase in prediction where the Control and Cohesion dimensions were involved.

TABLE I

CORRELATIONS BETWEEN DISAGGREGATED STRUCTURE VARIABLES AND ORGANIZATIONAL PERFORMANCE

		Simple Rs (Degrees of Freedom = 12)						Multiple-Rs (DF = 10)	
		A Information		B Value		C Control		A,B,C	
Simple Correlation	D Cohesion	ji= .60*	ki= .50	.22	.14	-.58*	-.37	.73*	.56
		jh= .18	kh= .34	-.04	-.16	-.15	-.18	.21	.42
		jg= .47	kg= .34	-.02	-.12	-.45	-.34	.52	.47
	E Compatibility	.06	.00	-.04	.43	.02	.12	.11	.50
		.21	-.06	.05	.18	.25	.34	.33	.57
		.27	-.02	.03	.23	.13	.19	.34	.29
	F Differentiation	.22	.50	.28	.24	.65*	.38	.69	.57
		.45	.39	.52*	.71*	.63*	.70*	.69	.81*
		.62*	.48	.56*	.47	.76*	.59*	.87*	.59
Multiple-R	D,E,F	.75*	.84*	.40	.52	.75*	.45		
		.75*	.70	.66	.71	.64	.75*		
		.84*	.70	.67	.48	.80*	.67		

* Significant at the .05 level.

ji = Data collection method in which individual -supplied data is obtained from Direct, i.e. first-person, responses.

jh = Data collection method in which individual -supplied data is obtained from Indirect, i.e. proxy, responses.

jg = Method in which individual -supplied data is obtained by both Direct and Proxy methods.

ki, kh, kg = Data collection methods in which environment -supplied data is obtained by Direct, Indirect, and Composite methods respectively.

TABLE II

CORRELATIONS BETWEEN STRUCTURE VARIABLES (AGGREGATED ACROSS METHODS OF MEASUREMENT) AND ORGANIZATIONAL PERFORMANCE

		Simple Rs (Degrees of Freedom = 12)				Multiple-Rs (DF=10)
		A Information	B Value	C Control	A+B+C	A, B, C
Simple R	D Cohesion	.46	-.09	-.46	-.11	.52
	E Compatibility	.13	.15	.16	.18	.18
	F Differentiation	.58*	.55*	.74*	.71*	.77*
	D+E+F	.72*	.46	.23		
Mult-R	D,E,F	.91*	.57	.79*		

*Significant at the .05 level.

No single method of measuring the individual dimensions was most effective for all dimensions. With respect to the Information-Cohesion dimension, data based on first-person (i.e. direct) responses in combination with data given by the individual vis-a-vis the environment (rather than by the environment vis-a-vis the individual) appeared most effective. This combination of methods was also most effective for measuring the Control-Cohesion dimension.

If one were limited to using only one of the 6 methods to measure all dimensions, the method of using the respondent's own data and taking the respondent's (rather than the environment's) point of view appears to be most effective.

The next most effective combination of methods involved pooling the Direct and Indirect methods and combining this with the method of taking the individual's viewpoint in preference to the environment's. In only two cases did the perspective of those in the environment appear to be slightly preferable to the perspective of the individual, i.e. (a) where Differentiation scores from Indirect (proxy) data were weighted and (b) where Control scores from Indirect data were weighted. In two cases it seemed preferable to use proxy rather than direct data, i.e. when measuring the Information-Differentiation and the Value-Differentiation dimensions.

Conclusions. The small number of organizations involved, the gross measures of organizational performance available and the rather brief instrument for assessing structure did not lead us to expect impressive correlations.

However, a substantial number of correlations consistent with expectations were obtained. The performance of this first edition of the Structure Assessment Instrument seems to warrant further development of the basic approach. Future development efforts will focus on the problem of selecting better semantic differential scales. It will be particularly desirable to find scales which can increase the effectiveness of the Compatibility dimension.

The unexpected finding that as the degree of Control ("Specificity") of interactions increases the organization's Performance decreases will need further study. It is suspected that the word pair "Specific-General" does not adequately reflect the type of Control which has the greatest relevance for organizational performance. In fact, "general" may connote control over a broader spectrum of activity whereas "specific" connotes control over a narrower range of activity.

Possible Use of the Instrument: This type of instrument should be useful for both theoretical and operations research. Its use in theory may be to produce answers to questions such as--(a) How much does the structure at the top of an organization resemble the structure at its bottom? (b) How is the internal structure of a system influenced by the external structure of that system? (c) How rapidly do structural changes flow up, down, across organizationsof a particular type? (d) What structural patterns are found in high-performance organizations of a particular type? (e) To what extent are alternative structural patterns substitutable for each other? (f) What techniques are most effective for changing low-performance into high-performance structures?

This type of instrument is particularly well suited for operations research in all types of organizations because it is not "situation-bound,"

i.e. the items are general and thus they can be used equally well in many types of organizations. Little time is required to administer and score the instrument (if scoring is computerized). The instrument should be useful for periodically assessing the structural "health" of the overall organization. Signs of excessive friction (incompatibility), blocked communications channels, ineffective subsystems, etc. should be much easier to identify and quantify than they are at present.

APPENDIX

TABLE III

CORRELATIONS BETWEEN NON-SCHOOL-CONTROLLED VARIABLES AND PUPIL ACHIEVEMENT AT THE END OF A TWO-YEAR TIME SPAN *
(N=14)

Variable	Correlation	Probability
1965 Achievement (a composite of First and Third grade reading and arithmetic test scores) **	.792	.001
Spread in the 1965 achievement test scores (i.e. an estimate of pupil heterogeniety)	-.615	.018
Expenditures per pupil (i.e. non-instructional expenditures are not included)	.529	.049
True tax valuation per square mile	.385	.171
Rate of enrollment increase (i.e. percent gain between 9/63 and 9/65)	-.335	.239
Pupils per square mile	.323	.259
Total enrollment (pupils in average daily attendance in grades K-12)	.299	.300
Criterion Variable (i.e. 1967 achievement--a composite of the third and sixth grade reading and arithmetic)**	Multiple R = .919	.040

*The above variables were used in developing a multiple regression equation for predicting school system output. The differences between the predicted output score and the actual output score obtained by a given school system was taken as an indicator of the system's overall performance.

**Composite scores were obtained by averaging the percentile rankings (e.g. of 3rd grade Reading, 3rd grade Arithmetic, 6th grade Reading...etc.) obtained by a given district.

TABLE IV

INTERCORRELATIONS OF INSTRUMENT SUBVARIABLES
AGGREGATED ACROSS METHODS

(N = 14)

	2	3	4	5	6	7	8	9
1. Cohesion, Information	-.03	-.74	-.19	-.20	-.08	-.34	-.05	.29
2. Cohesion, Value		-.22	-.57	-.66	-.60	.05	-.40	-.29
3. Cohesion, Control			.10	.39	.27	.16	.09	-.28
4. Differentiation, Information				.49	.56	.36	.66	.52
5. Differentiation, Value					.61	.29	.47	.40
6. Differentiation, Control						.31	.32	.39
7. Compatibility, Information							.71	.57
8. Compatibility, Value								.66
9. Compatibility, Control								

ORGANIZATIONAL STRUCTURE SURVEY

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The effectiveness of an organization is influenced by the interactions between the key individuals within it. This survey measures, in a general way, the type and magnitude of these interactions as they appear to those directly involved. A comparative study of these interaction patterns is expected to lead to a better understanding of the effect which different patterns have on the performance of complex organizations.

DIRECTIONS

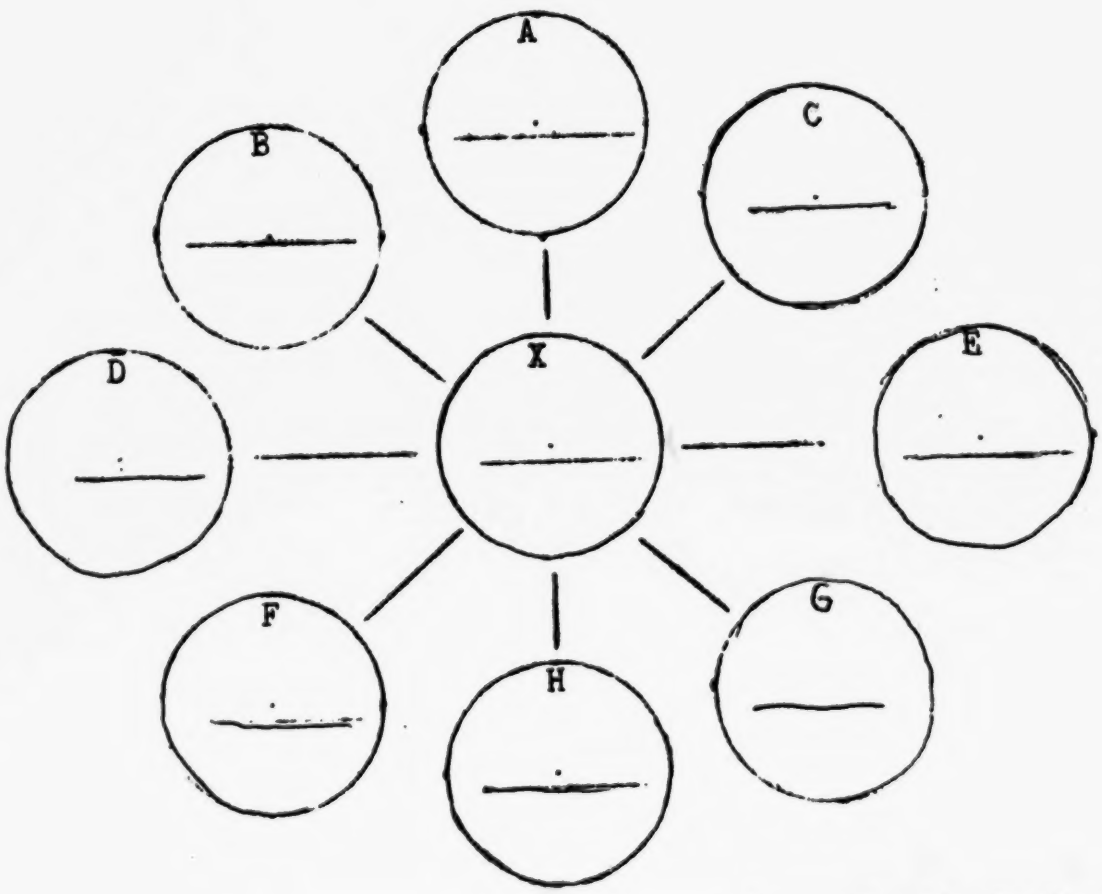
1. In the diagram on page 2, each circle represents a position (one individual) in the organization. Write your last name in the center circle. Note that you are also making a carbon copy.

2. In the topmost circle, write the last name of the individual who is your immediate supervisor. In the remaining circles, write the last names of seven individuals whose interactions with you are of key importance in getting the work of the organization done. Include for consideration the professional staff from the entire organization (not just those who are present in the room with you).

3. When all eight positions are filled in, tear out both page 2s and attach each to the inside front covers of the two survey booklets you have. Keep one booklet and exchange the other with someone you mutually interact with.

(tear)

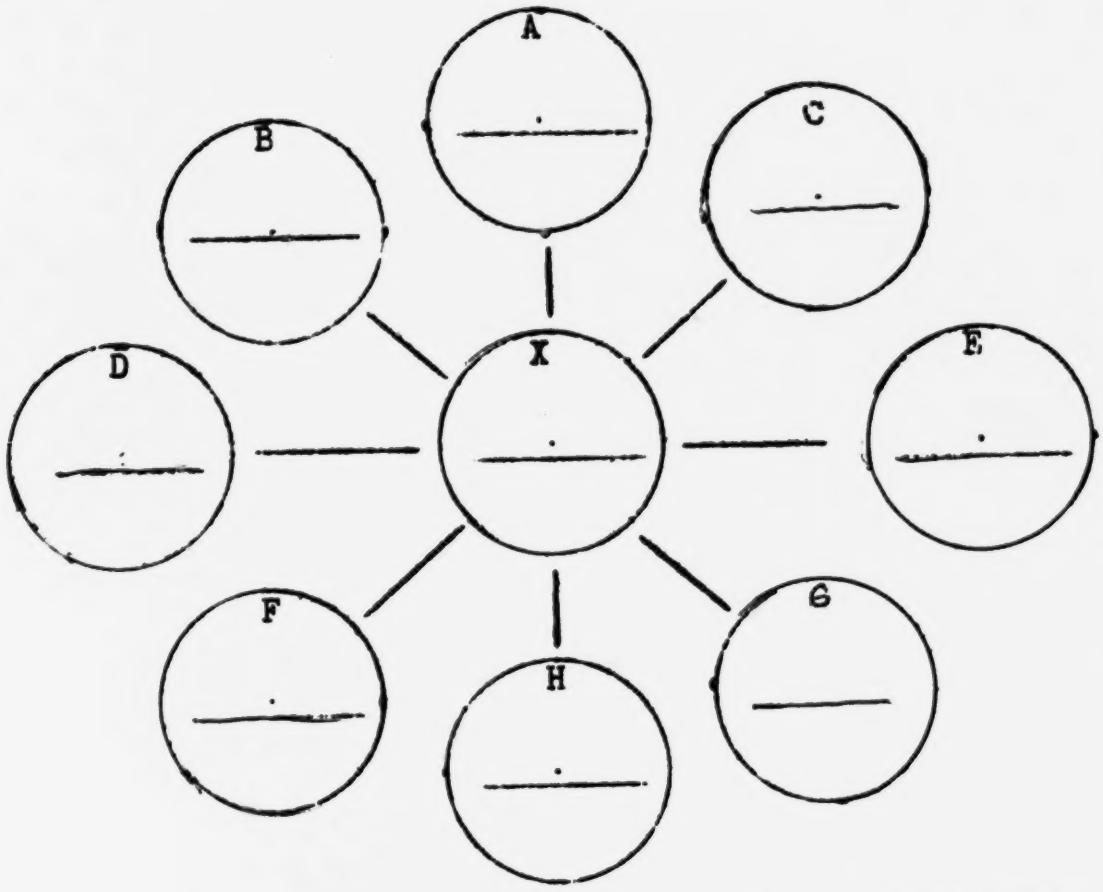
Positions which interact with X:



Respondent's last name:_____

(tear)

Positions which interact with X:



Respondent's last name:_____

DIRECTIONS(continued)

4. Each booklet contains scales for rating specific interactions. If you feel that the interaction at the top of the set of scales is very closely related to one end of the scale, you should place your check-mark as follows:

frequent ✓ : ___ : ___ : ___ : ___ : ___ : ___ occasional

or

frequent ___ : ___ : ___ : ___ : ___ : ___ : ✓ occasional

If you feel that the interaction is quite closely related to one or the other end of the scale (but not extremely), you should place your check-mark as follows:

frequent ___ : ✓ : ___ : ___ : ___ : ___ : ___ occasional

or

frequent ___ : ___ : ___ : ___ : ___ : ✓ : ___ occasional

If the interaction seems only slightly related to one side as opposed to the other (but is not really neutral), then you should check as follows:

frequent ___ : ___ : ✓ : ___ : ___ : ___ : ___ occasional

frequent ___ : ___ : ___ : ___ : ✓ : ___ : ___ occasional

DIRECTIONS(continued)

The direction toward which you check, of course, depends upon which of the two ends of the scale seem most characteristic of the interaction you are judging. If you consider the interaction to be neutral on the scale, or if the scale is completely irrelevant to the interaction, mark the middle space:

frequent___:___:___:✓:___:___:___occasional

IMPORTANT: (1) Place your check-marks in the middle of spaces, not on the boundaries.

(2) Be sure you check every scale for every interaction. Do not omit any.

(3) Put only one check-mark on a single scale.

Work at fairly high speed. Do not worry or puzzle over individual items. It is your first impressions, your immediate "feelings" about the items, that we want. On the other hand, please try to give your true impressions.

5. Do first your own booklet and then the one you have received in exchange. When you have completed both booklets, please seal and return to the researcher. All responses will be treated confidentially. Thank you for your cooperation.

From X's viewpoint, X → A interactions are:

frequent___:___:___:___:___:___:___occasional

indispensable___:___:___:___:___:___:___useful

specific___:___:___:___:___:___:___general

From X's viewpoint, A → X interactions are:

frequent___:___:___:___:___:___:___occasional

indispensable___:___:___:___:___:___:___useful

specific___:___:___:___:___:___:___general

frequent--occasional	Degree of contact, involvement, activity, information, etc. involved in interactions.
indispensable-useful	Degree of importance, thrust, potency, urgency, etc. which characterizes interactions.
specific--general	Degree to which interactions require or are related to specific(detailed) types of behavior.

From X's viewpoint, X ⟶ B interactions are:

frequent___:___:___:___:___:___:___occasional

indispensable___:___:___:___:___:___:___useful

specific___:___:___:___:___:___:___general

From X's viewpoint, B ⟶ X interactions are:

frequent___:___:___:___:___:___:___occasional

indispensable___:___:___:___:___:___:___useful

specific___:___:___:___:___:___:___general

frequent--occasional	Degree of contact, involvement, activity, information, etc. involved in interactions.
indispensable-useful	Degree of importance, thrust, potency, urgency, etc. which characterizes interactions.
specific--general	Degree to which interactions require or are related to specific(detailed) types of behavior.

From X's viewpoint, X ⟶ C interactions are:

frequent___:___:___:___:___:___:___occasional

indispensable___:___:___:___:___:___:___useful

specific___:___:___:___:___:___:___general

From X's viewpoint, C ⟶ X interactions are:

frequent___:___:___:___:___:___:___occasional

indispensable___:___:___:___:___:___:___useful

specific___:___:___:___:___:___:___general

frequent--occasional	Degree of contact, involvement, activity, information, etc. involved in interactions.
indispensable-useful	Degree of importance, thrust, potency, urgency, etc. which characterizes interactions.
specific--general	Degree to which interactions require or are related to specific(detailed) types of behavior.